T 50: Search for Dark Matter 2

Time: Tuesday 16:15–18:00 Location: T-H35

T 50.1 Tue 16:15 T-H35

Optimisation of the TPC aspect ratio for the DARWIN observatory — •Sebastian Vetter — Institute for Astroparticle Physics (IAP), Karlsruhe Institute of Technology (KIT)

DARWIN is a proposed next-generation astroparticle physics observatory focused on the direct detection of WIMP Dark Matter. It will use 40 tonnes of natural xenon inside a dual-phase Time Projection Chamber (TPC) following the technology of the successful detectors that use noble elements as active material. Due to the elusive nature of Dark Matter and the envisaged unprecedented discovery potential, DARWIN requires an ultra-low background level.

The final design of many components of the detector is not decided yet. One of the central parameters for optimization is the aspect ratio (AR) of the TPC. A higher AR leads to better light collection and shorter electron drift lengths, but also comes with different fractions of sensor and cryostat materials, being a source of external background.

In this talk we present results based on detailed 3-dim Monte Carlo simulations on the influence of the AR on the S1 signal detection efficiency for WIMPs as well as on background components such as dark count rates and neutrons from the TPC materials.

T 50.2 Tue 16:30 T-H35

The Freiburg DARWIN Demonstrator — •Julia Müller — University of Freiburg

Liquid xenon (LXe) time projection chambers (TPCs) are the leading detector technology for searches for dark matter in form of WIMPs. DARWIN will be the ultimate LXe-based dark matter detector covering the entire accessible parameter space for WIMP masses above a few GeV/c^2, superseding current detectors in size and sensitivity. The technical realization of its central low-background TPC with a diameter of about 2.6m will be very challenging due to the size of the detector, the low-temperature operation, and the required radiopurity levels. The DARWIN detector test platform PANCAKE at the University of Freiburg will be used to develop and test flat detector components with diameters up to the DARWIN-scale. We will present an overview of the platform that can accomodate up to 400 kg of xenon gas and present first results from the commissioning phase.

T 50.3 Tue 16:45 T-H35

Full MonteCarlo simulations of the cosmogenic background for the DARWIN observatory at different underground locations — •Jose Cuenca-García for the DARWIN-Collaboration — Institute for Astroparticle Physics (IAP), Karlsruhe Institute of Technology (KIT)

The DARWIN observatory is a proposed next-generation experiment focused on the direct detection of Dark Matter. It will use 40 tonnes of natural xenon inside a dual-phase Time Projection Chamber (TPC) being the evolution of the detectors that use noble elements as active material. The final design of the detector and its location are not decided yet. Besides the direct detection of Dark Matter a large variety of science channels can be studied, as for example $0\nu bb$, Axion Like Particles or solar neutrinos, among others. To fully exploit these physics goals an ultra-low background level is required. Although this type of experiments is located in underground laboratories to shield them against the cosmic radiation, muons and their induced secondary particles can still contribute significantly to the background. This *in situ* production cannot be suppressed and further veto systems are needed. We present here the simulations of the cosmogenic background for several underground laboratories. In particular, we focus on the production of some nuclei that can potentially affect the science channels of interest.

T 50.4 Tue 17:00 T-H35

DARWIN background estimations through multi-scatter separation — •Maike Doerenkamp, Antoine Chauvin, Andrii Terliuk, and Stephanie Hansmann-Menzemer — Physikalisches Institut, Universität Heidelberg

The DARWIN experiment is a future multi-ton dual-phase xenon TPC, whose primary goal will be the search for WIMPs through nuclear recoil. One of the major backgrounds in WIMP-nucleus interactions are radiogenic neutrons. A single nuclear recoil caused by a neutron is indistinguishable from one caused by a WIMP. However, due to their much shorter mean-free path, more than 90% of neutrons scatter multiple times within the detector. This can be exploited for background rejection. This talk will describe a method to separate single- and multi-scatter events in a dual-phase xenon TPC and how this translates to the expected neutron background rates in DARWIN.

T 50.5 Tue 17:15 T-H35

Estimation of electronic recoil leakage into nuclear recoil signal for DARWIN — •Antoine Chauvin, Maike Doerenkamp, Andrii Terliuk, and Stephanie Hansmann-Menzemer — Physikalisches Institut, Universität Heidelberg

The DARWIN experiment is a proposed future Direct Dark Matter detector which aims to detect WIMPs through WIMP-nucleus interactions, in a multi-ton liquid xenon target. Is goal is to become the most sensitive experiment to WIMP-nucleus interaction. To estimate this sensitivity, good models for signal and background generation, and of the detection processes, are fundamental. Electronic Recoil (ER) processes are the dominant background. Thus a good rejection of ER background, and an estimation of the ER leakage in Nuclear Recoil (NR) signal, is fundamental to achieve a high sensitivity. In this talk, I will report on the setup of a simulation of the DARWIN detection process, and its use to estimate the ER leakage fraction.

T 50.6 Tue 17:30 T-H35

Charge detection via proportional scintillation in a single-phase liquid xenon TPC — •Florian Tönnies for the DARWIN-Collaboration — Albert-Ludwigs-Universität Freiburg, Deutschland

Dual-phase liquid/gas xenon TPCs are a well-established detector technology to search for WIMP Dark Matter. Nevertheless, the homogenious detection of the charge signal via proportional scintillation will be challenging at the scale of the next-generation detectors due to the size of the TPCs. The detection of the charge signal in the liquid phase of a single-phase TPC might be an option to circumvent this issue. In Freiburg we successfully operate a single-phase TPC demonstrator which exploits proportional scintillation in the strong electric field around thin wires. Some of the most recent results will be presented in this talk.

T 50.7 Tue 17:45 T-H35

The MonXe Radon Emanation Chamber — •Daniel Baur for the DARWIN-Collaboration — Albert-Ludwigs-Universität Freiburg

Liquid xenon-based experiments are currently leading the search for WIMP dark matter. Their electronic recoil background in the energy region of interest is dominated by the naked (i.e., not accompanied by the coincident emission of a gamma-ray) beta decays of ^{214}Pb, a progeny of ^{222}Rn which is emanated from all material surfaces. Consequently, the reduction of ^{222}Rn emanation is mandatory for the success of next-generation dark matter experiments with multi-ton xenon targets such as DARWIN.

The ^{222}Rn surface emanation can be measured directly with a radon emanation chamber. In such a detector the daughters of ^{222}Rn are collected electrostatically on a silicon PIN diode and the subsequent alpha decays are measured spectrometrically. We report on the MonXe radon emanation chamber, which was recently commissioned in Freiburg for the radiopurity assay of DARWIN.